

# City of Lamar Light & Power and ARPA/Springfield Wind Project



*Consulting The Wind Energy Specialists<sup>sm</sup>*

# Overview of the Two Projects

Leon Sparks



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- x **Two sites, 7.5 MW total New Wind Generation**
- x **Located in Lamar and Springfield areas of southeastern CO**
- x **Commissioned Feb. 2004**
- x **Serving local load in 2 rural communities**

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- x **Owned by ARPA (2 turbines) and LL&P (3 turbines)**

- x **GE 1.5 MW turbines with 70.5 meter rotor**

- x **Operated by LL&P**

- x **Turbine Maintenance by GE**

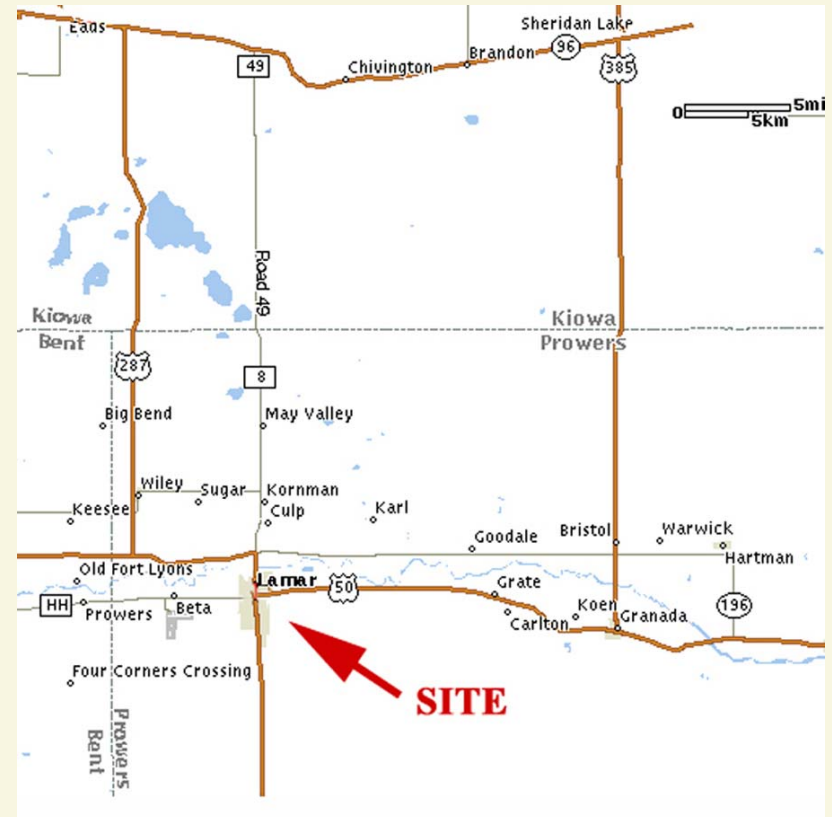
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# Location of Lamar Project & Springfield Turbine #1

- X **LL&P and ARPA  
6 MW Site**
- X **Southeast of  
center of Town**
- X **Near new  
Substation and  
Distribution Line**



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# Location of Springfield Turbine #2

- X **Springfield 1.5 MW Site**
- X **3 miles South of Town of Springfield**
- X **New Distribution Line built to Site**



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# The Utility Perspective



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# **Lamar's Interest in Wind Power**

- x Green Power, “the right thing to do”**
- x Rising natural gas prices and volatility**
- x Good wind resources available in the service area**



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# **LL&P Hopes to Gain from the Project:**

- x Reductions in future Costs of Energy**
- x Diversification of Generation**
- x Pollution offsets from coal plant conversion**

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# ARPA's Interest in Wind Power

- x **Began after LL&P got started**
- x **Development of Demonstration project with Town of Springfield/Baca County**
- x **Data from initial measurements indicated there was good potential**
- x **Local Springfield load was nearby – so no transmission issues**



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# Community Involvement

- x Buzz in Southeast Colorado has been wind due to Enron 6-7 years ago
- x Radio morning talk shows, newspaper coverage
- x Much interest in wind and siting projects on land
- x In LL&P's case, site to be located in its 167 sq. mile service area



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# **Agreement between Lamar and ARPA**

- x Lamar & Springfield have all requirements PPA with ARPA**
- x ARPA amended Lamar contract to allow 3-1.5 MW turbines into energy mix**
- x 5 turbines to be operated from LL&P's control room**
- x Generated power (ie. wind, steam, diesel) is mixed with purchased power from 7 ARPA communities and is sold back to the ARPA members at a blended rate**



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# **Lamar, ARPA & Tri-State Agreement**

- x Agreements allow for delivery of surplus power into Tri-State's system from ARPA to ARPA members at an agreed-on price – currently about 0.8 cents per kWh.**
- x In near future, such transmission arrangements under Tri-State's Open Access Transmission Tariff.**
- x In case of overproduction, ARPA can curtail or deliver to other members**
- x As a result, project sized to fit local load, and to minimize over-production.**



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A faint, yellow-toned map of the Southern Ocean is visible in the background. It shows the outlines of South America, Africa, and Australia, along with various latitude and longitude lines. The word 'SOUTHERN OCEAN' is partially visible at the top.

**How is this being funded and  
what is the cost of power?**



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# Construction and Project Financing

- x **Local banks came to use offering help with construction loans and advance monies**
- x **Explored USDA Rural Utilities Service approach**
- x **Final decision on financing involved a bond issue**



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# Difficulties in Issuance of Bonds

- x **LL&P attempted to get AAA rating by having bond issue insured by AAA-rated bond co.**
- x **Only 4-5 AAA rated companies. Initial efforts not successful.**
- x **Credit rating agencies & bond industry wary of electric utilities due to Enron, CA market, and blackouts in Northeast**
- x **Sense of volatility in electric industry**



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# **Solution to the Problems**

- x XL Capital Assurance reviewed the issue.**
- x XL is well know but had not been involved in the electric industry for several years.**
- x Ultimately they insured both the LL&P and ARPA bond issue.**
- x Net interest cost for 20 year bonded issue is 4.26%. Saved somewhere between 20 to 50 basis points by gaining AAA rating vs. AA rating.**



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# Production Costs

- x Original goal was 0.04 ¢/kWh net for Lamar's fixed cost for wind
- x If 13.8 M kWh generated = 0.0425 ¢/kWh
- x If 12.5 M kWh generated = 0.045 ¢/kWh
- x Lamar's blended ARPA rate is 0.045 ¢/kWh
- x If Lamar was operating its steam plant at current natural gas prices, cost would be 0.065-0.070 ¢/kWh



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# The Utility as Operator



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# **Learning to Operate the Facilities**

- x Plant operator and field tech sent to GE training for 3 weeks.**
- x GE allowed operators to partner with their crews for training & experience in field and control operations**
- x 5 Techs were climb certified so that techs could work with GE to commission turbines. This was invaluable training for LL&P staff.**



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# **Learning to Operate the Facilities, cont.**

- x Power plant operators, staff engineer, and technology staff spent a shift working with controllers at Colorado Green**
- x Considering sending a field technician to the GE converter training within the next year.**



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# From Concept to Project Realization

Evelyn Carpenter, P.E.



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# Wind Feasibility Study

- x **Initial Investigation by Lamar & ARPA**
  - x **NREL provided wind data summaries and initial site review**
  - x **Potential Sites Identified**
  - x **Preliminary data collection at 3 sites for Lamar, 1 for ARPA**
  - x **SeaWest Consulting was Engaged in June 2002 to formulate a strategy for project realization**



# **Wind Feasibility Study, Phase 1**

## **Initial Review & Feasibility Analysis**

### **60 Days**

- x Comparative Site Analysis of existing sites**
  - x Wind Resource Assessment – desktop topographical study, assessment of existing data, site inspection of current monitoring program**
  - x Site permit ability and lease ability**
  - x Compatibility with distribution system**
  - x Cursory construction feasibility**



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# Wind Feasibility Study, Phase 1 Initial Review & Feasibility Analysis



## x **Conclusions**

- x **Recommended a Modified Wind Data Collection Program**
- x **Recommended abandoning 1 of the selected sites**
- x **Recommended new sites**

# **Wind Feasibility Study, Phase 2**

## **Secondary Feasibility & Cost Analysis**

### **Approximately 7 months**

- x **Draft lease for site control**
- x **Met program implementation**
  - x **Installation of new met towers & equipment**
  - x **Secure long-term wind correlation data sources**
  - x **Energy Estimates**
  - x **Daily and Annual Pattern of Wind Generation**
- x **Recommendation of 1 site over the other**



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# **Wind Feasibility Study, Phase 2**

## **Secondary Feasibility & Cost Analysis**

- x **Basic site layout**
- x **Secondary Feasibility of Selected Site including preliminary engineering feasibility review**
- x **Capital, installation, & operating cost estimates**
- x **Turbine analysis**
- x **Energy contractual costs, REPI payments**
- x **Preparation for permitting**



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# Lamar Feasibility Conclusions

- x **GE 1.5 Wind Turbine is a good choice**
- x **Timing is dictated by Colorado Green Project 25 miles away**
- x **Site is windy at higher elevations/heights**
- x **Interconnection would work well at this site**
- x **No major barriers to permitting or environmental issues**



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# Lamar Conclusions, cont.

- x **Incentives (REPI, Green Tag sales) will be relevant to net energy costs**
- x **Colorado Green Project presents a strong opportunity to lower development and operating costs**
- x **Colorado Green opportunity will not likely recur**
- x **With sale of Green Tags, cost of energy will be approximately 4 cents/kw-hr**



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# ARPA/Springfield Study and Conclusions

- x **Started in 1Q03**
- x **Basically same process as Lamar, however also asked to evaluate potential for large scale project in the area**
- x **Springfield site is very windy (>19 mph)**
- x **Baca County encourages Wind Projects and the Economic Growth that accompanies them**
- x **Colorado Green Project presents a strong opportunity that will not likely recur**
- x **With sale of Green Tags, cost of energy will be below 3 cents/kw-hr**



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# **Decision Process at LL&P and ARPA**

- x Feasibility Report evaluated by the LL&P and ARPA Boards**
- x Each voted to proceed, contingent on the Colorado Green Project proceeding**
- x Approval based on maintaining or lowering future costs of energy**
- x Part of a developing generation plan**



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# Timing is Everything!



- x **Colorado Green timetable –start, then stop, then start, then stop, then RUN!**
- x **Interest rates are low**
- x **Contractors & suppliers are available locally to build a small project cost effectively**
- x **GE is available to do commissioning**
- x **NOT PTC dependent**

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# **Phase 3 – Design and Preparation for Construction**

- x Enter turbine ordering discussions with GE Wind**
- x Select turbines, balance of plant components**
- x Prepare equipment, construction cost estimates**
- x Finalize cost estimates**



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# Design, Phase 3

- x **Civil Engineering began**
- x **Biological and Cultural Resources Surveys completed**
- x **County Permits acquired**
- x **Structural Engineering Design**
- x **Electrical Engineering Design**
- x **Construction Bids Solicited**

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# Construction, Phase 4

- x Bids evaluated, Contractors selected
- x Turbine deliveries coordinated
- x Installation during November through February
- x GE Technical Support on-site and in the area from Colorado Green

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# Construction

- x **Distribution Lines built by LL&P and Springfield**
- x **Roads, Foundations took 45 days**
- x **Complete construction took 4 months November through February**

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# Operating Phase

- x Turbine maintenance provided by GE Wind from Colorado Green Project
- x Operated by 3 staff at LL&P from Control Room
- x Visibility of all 5 turbines through SCADA system

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# Interconnection and Electrical System

Rob Sims



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# Interconnection - Basics

- x **Generally interconnection design was similar to a large load.**
- x **Output voltage of turbines is 575 V. 3-phase, increased to distribution voltage with a 3-phase padmounted transformer at tower base.**
- x **Both Projects were interconnected into existing utility 3-phase distribution systems at medium voltage level.  
(Lamar = 24.9kv/14.4kv    ARPA = 12.47kv/7.2kv)**



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# Interconnection - Basics

- x **Electrical design criteria based on applicable NEC, REA, and host utility standards along with “Good Utility Practice”**
- x **Standard 3 phase medium voltage energy metering at the point of interconnection**
- x **All electrical infrastructure on site is underground for appearance and crane safety**



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# **Interconnection – Special Considerations**

- x The GE turbine has the ability to regulate Var flow in order to minimize voltage impacts to the system. (PF range = 0.9 under excited to 0.95 over excited at rated power)**
- x Special protection considerations for islanding (isolation) of the wind project with other loads on the same feeder. Special relaying system was used for high speed sensing of loss of utility connection with an action of generation tripping (transfer trip)**
- x Turbine has limited fault contribution for fault sensing and clearing**



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# Conclusions

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# Conclusions

- x **Process is complex, requires experienced guidance in order to capture full economic value and avoid costly mistakes**
- x **Wind assessment and cost evaluation are most critical phases**
- x **Need to budget for operations integration and monitoring costs**
- x **Requires more hands-on operator involvement than conventional generation**



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# Conclusions

- x **Site Selection is very important (> 10% differences in energy between nearby sites)**
- x **“Coat tails” of larger project is very valuable for initial and long-term vendor support for a small project**
- x **Work with experienced team members**
- x **Windy site can deliver wind power under 3 cents/kw-hr under the right financial structure**



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**Questions**

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